DOCUMENT RESUME

ED 310 053 SO 020 204

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TITLE Pilot Study: Impact of Computer Simulation on Students' Economic Policy Performance. Pilot Study.
PUB DATE 7 Apr 88
NOTE 12p.; Paper presented at the Annual Meeting of the Midwest Economics Association (Chicago, IL, April 7-9, 1988).
PUB TYPE Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; *Computer Assisted Instruction; *Computer Simulation; Computer Software; *Economics; *Economics Education; Policy Formation; Student Evaluation
IDENTIFIERS *Macroeconomics; Macroism

ABSTRACT

Fiscal and monetary policies taught in macroeconomic principles courses are concepts that might require both lecture and simulation methods. The simulation models, which apply the principles gleened from comparative statistics to a dynamic world, may give students an appreciation for the problems facing policy makers. This paper is a report of a pilot study of a policy making simulation, "Macroism," provided by a publisher as part of a package for a macroeconomics textbook conducted at Southeast Missouri State University. A review of studies concerning learning and economic simulations reveals that computer assisted instruction has an effect on learning, but does not establish a clear relationship to the text/lecture approach of instruction. "Macroism" is based on an econometric model of the United States economy, and is available for both Apple and IBM computers in an interactive or classroom version (used for this study). While the students clearly enjoyed the simulation, there is limited evidence that student learning improved as a result of participation in the simulation. Students' cognitive abilities in the area of policy making are likely to be enhanced as a result of playing "Macroism," but more study is needed in this area. Nine references and a "Macroism" sample problem are included. (PPB)

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PILOT STUDY: IMPACT OF COMPUTER SIMULATION ON STUDENTS' ECONOMIC POLICY PERFORMANCE

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Presented at the
Midwest Economics Association Meetings
Chicago, Illinois
April 7, 1988

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Pilot Study: Impact of Microcomputer Simulation on Students' Economic Policy Performance

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I. Introduction

Many concepts in principles of economics are, perhaps, best explicated via the lecture method. These might include such concepts as opportunity costs, the Keynesian Cross diagram, and efficiency of the competitive market model. Some concepts, however, are difficult for students to grasp from viewing a lecture. These may require additional methods of teaching as simulations or games for fuller comprehension by students.

Fiscal and monetary policies which are taught in the macroeconomic principles course are concepts which might require both lecture and simulation methods. Lectures can be used to teach the basic approaches and tools of policy-making. However, "Simulation models, which apply the principles gleaned from comparative statics to a dynamic world, may give students an appreciation for the difficult problems confronting policy-makers." (Siegfried and Fels [1979, p. 940])

This paper is a report of a pilot study of a policy-making simulation which is being conducted at Southeast Missouri State University. The simulation which is being used is provided by a book company as part of a package for a principles of macroeconomics textbook (Byrns and Stone [1987]). After a brief review of earlier research on simulations, the third section of the paper will describe the Byrns and Stone simulation (called Macrosim) and the results of its use in five sections of Principles of Macroeconomics. The final section of the paper will include a summary and evaluation of the evidence.

II. Recent Research on Simulations

In 1979, Siegfried and Fels were compelled to state that "...the conclusions about the effectiveness of CAI [games and simulations] in improving understanding of economics are pessimistic." (Siegfried and Fels [1979, p. 940]) The evidence from studies seemed to indicate that students enjoyed learning by playing games and simulations, but that there was little or no advantage from such methods as compared to the traditional lecture/textbook approach.

One exception to the conclusion of Siegfried and Fels was the study by Emery and Enger [1972]. Their use of a fiscal policy simulation appeared to improve student understanding of various fiscal policy concepts. The evidence consisted of a statistically significant difference in improvement from a pre-test to a post-test for students playing the game versus those who did not.

Schenk and Silvia [1984] listed several reasons why researchers, in general, may not have found simulations and games to be superior to the traditional textbook/lecture approach. In some cases, the instructional materials may not have been very good. Clearly, some of the earliest simulation models appear woefully simplistic and naive when compared to the complex computer models of today. But even if the simulations are well-constructed, they could be improperly used. As Schenk and Silvia point out [1984, p. 241], for simulations to be effective they need to be complemented with student guides and explicit instructional objectives. There are further problems with the evaluation of the effectiveness of simulations. Student benefits from participation in a simulation may include improved analytical and critical thinking, a

better appreciation of the difficulties of policy-making, as well as greater familiarity with computer technology. A TUCE-based evaluation would have a tendency to underestimate the total benefits from a simualtion.

A carefully designed study of simulations by Fraas [1982] was successful in anticipating some of the problems outlined by Schenk and Silvia. As a result, Fraas was able to draw some very specific conclusions from his experience. He found that students with lower pre-course TUCE scores tended to learn more when they were taught by simulation/gaming methods. Students with higher pre-course TUCE scores learned more when taught by the lecture/discussion method. A similar dichotomy existed when students were grouped by SAT scores. Those with lower SAT scores learned more in a simulation/gaming classroom while those with higher SAT scores did better in a lecture/discussion format.

A more recent study by Post [1985] concludes that computer simulation and games (CAI) do improve student scores but not significantly more than do traditional assignments. He does conclude that CAI is better than lecture alone, though his evidence for such a conclusion is not that well documented.

It would appear from this brief summary of some of the research that further study of simulation as a teaching technique is needed. This is warranted not only to address the one question which has dominated the research-is CAI more effective than the lecture/text approach-but also to assess its role in achieving some of the other objectives as outlined by Schenk and Silvia [1984]. The next section will present both anecdotal and statistical evidence to assess the effectiveness of the Byrns and Stone simulation in a Principles of

Macroeconomics course.

III. Description of Macrosim and Evidence

Robinson [1983] states that simulations should demonstrate that 1) no one knows exactly how the economy operates, 2) policy-making involves trade-offs between conflicting objectives and 3) accurate forecasting can improve policy-making by removing potentially adverse situations before they occur. The Byrns and Stone policy simulation called Macrosim demonstrates these points quite adequately.

Macrosim is a simulation based on an econometric model of the U.S. economy. While the exact model is not specified in the accompanying description of the simulation, the reader is told that the model has a fairly realistic lag structure. Macrosim is available for both Apple and IBM personal computers. There are two versions of Macrosim: 1) an interactive version which the student can play alone and 2) a classroom version wherein the instructor enters all data and the students see only printouts from the computer. The interactive version is most appropriately used if the class size is relatively small and students are familiar with personal computers. Because of large class sizes at Southeast Missouri State, the classroom version was used.

To implement the classroom version of Macrosim, students in five sections of Principles of Macroeconomics were divided into groups of five or six. (The sections averaged 35 students each.) Each group was given an initial printout (see appendix for an example) which included

data on five economic variables (GNP, the unemployment rate, the interest rate, the inflation rate, budget balance) for the past six years. There are six possible scenarios from which to choose. The six are stable economy, recession, depression, budget deficit, inflation and stagflation. The scenario which a student group faces is described in the initial printout so they have an idea of the direction the economy is heading when the simulation begins.

The role of the student group is that of the President who must make choices for seven policy instruments. The President receives advice (which is generally limited in usefulness) of various types: political, economic and military. Given the advice and the economic conditions, the group then makes decisions on the seven policy variables. There are four fiscal policy variables: excise taxes, tax rates, government spending, and investment tax credits. There are three monetary policy variables: open market operations, the discount rate and reserve requiremnts. The policy options which the students have are: increase a policy variable (0 to 10%), decrease a policy variable (0 to -10%) and no change. The students tend to learn quickly that large changes in policy variables can frequently have destabilizing effects on the economy.

The policy simulation can be conducted for up to eight periods. The procedure is to give students their initial printouts outlining the data on the economy and the scenario which they face. The students then submit their policy choices. Generally, the first time this is done requires about 30 minutes. At the beginning of the next class period, students receive new printouts which give the results of their policy choices on the five economic variables (GNP, unemployment, etc.) The

students then evaluate their results and submit new policy options. It usually takes about 15-20 minutes for the second and subsequent periods.

Instructor time to enter student choices and to generate new printouts is minimal. For 15 groups the time required was about 40 minutes per period. The actual entering of data is quite simple and could easily be done by a graduate student or student worker.

The students clearly enjoyed the simulation experience, even though at times they were frustrated by the results which they obtained. For example, six groups played the simulation under the budget deficit scenario. Every group precipitated a recession in trying to narrow the deficit. This, of course, caused the actual deficit to grow larger. Despite these types of setbacks, students were eager to participate in the simulation. Attendance in all sections increased during the time the simulations were conducted. On a post-course student evaluation in three of the sections, students were asked what they liked best about the course. By a ten to one margin they indicated the simulation was their favorite part of the course.

The TUCE (Saunders [1981]) was used to assess the learning of students who played Macrosim. Their results on the Macro TUCE, version A were compared to students in six sections who did not participate in Macrosim. The latter students took Principles of Macroeconomics from two other instructors, but they used the same text, Byrns and Stone [1987]. A pretest was not administered in all sections, so comparisons were not possible as to economic knowledge possessed by students in the different sections (five with Macrosim and six without). However, testing with the TUCE from previous semesters had yielded a fairly consistent average of 9.3 right (31%) on the pretest. There was no

reason to expect any significant deviations from that pre-course average.

Eighteen questions (2,4,6,9,11,12,13,16,18,19,20,22,23, 24,25,27,29,30) were identified beforehand as policy or policy-related questions. The twelve remaining questions were deemed to be nonpolicy questions. It happened that 135 students from the five Macrosim sections and 135 students from the six sections without Macrosim took the posttest, Macro TUCE A. For the 12 nonpolicy questions, the mean was 50.4% correct for the Macrosim sections and 47.3% correct for the sections without Macrosim. The difference in the means is not significant at the 10% level ($t = 1.45$). For the eighteen policy questions, the students in the Macrosim sections achieved a mean of 43.6% correct vs. 36.2% for the students without Macrosim. The difference in the means is significant at the 5% level ($t = 3.51$). The eighteen policy questions were also divided into the three types of questions suggested by Saunders [1981]: recognition and understanding, explicit application and implicit application. In all three cases the means of the Macrosim sections were approximately seven percentage points higher than the means of the sections which did not use Macrosim. This offers some evidence that Macrosim improved understanding of policy for students who participated in the simulation. Clearly, they learned no less. The fact that both groups performed about as well on the nonpolicy questions would give some indication that the difference in means on the policy questions was not due to other factors as student intelligence, motivation, etc. However, it would be useful to test for the influence (if any) of these other factors.

IV. Summary and Evaluation

The experience with Macrosim at Southeast Missouri State is similar to what has been found for simulations at other colleges and universities. The students clearly enjoyed the simulation; most said it was their favorite part of the course. There is limited evidence that student learning improved as a result of participation in the simulation.

The pilot study on the effects of Macrosim on student learning needs to continue for several semesters. There is a need to control for student and instructor differences in order to get a clearer picture of the simulation's effectiveness. The use of the TUCE both pre and post in all sections would be a major step in that direction.

Despite the need for further study, a few tentative conclusions can be made by way of a summary evaluation. Macrosim is a sophistcated simulation of policy-making in the macroeconomy which can give students a greater appreciation of the difficulties of fomulating policies in a complex economy. Student's cognitive abilities in the area of policy are likely to be enhanced as a result of playing Macrosim, though more study is needed in this area. Students enjoy playing Macrosim and it can be useful in generating interest in economics. Given the nature of Macrosim, it cannot be used until the last few weeks of the course. This means that Macrosim can be used as a summary instrument for many of the topics in a principles of macroeoconomics course. In that way, it makes an ideal "capstone" for such a course.

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MACROSIM: A Macroeconomic Simulation
to Supplement ECONOMICS 3/e by Ralph Byrns & Gerald Stone
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TEAM Y:

MACROSIM is a macroeconomic computer simulation designed to provide players with a sophisticated and enjoyable treatment of macroeconomic policy making. Grounded in sound macro theory, the simulation illustrates the interdependencies of economic mechanisms and the problems encountered by governing bodies in formulating stable economic policy.

THE INITIAL SCENARIO:

The economy is sliding into a recession. Prices are rising, and there is a sizable budget deficit. The voters hope you can deliver on your promise to reverse the decline and balance the budget before the next election. Good luck!

ECONOMIC TREND DATA:

Year	GNP	Unemployment	Interest	Inflation	Budget Balance
2000	1878 Bil.	7.0 %	8.0 %	6.4 %	-165 Bil.
1999	1743 Bil.	7.1 %	6.5 %	5.9 %	-146 Bil.
1998	1578 Bil.	7.6 %	6.2 %	5.2 %	-135 Bil.
1997	1484 Bil.	8.6 %	7.4 %	5.4 %	-120 Bil.
1996	1340 Bil.	9.1 %	6.8 %	4.1 %	-54 Bil.
1995	1282 Bil.	10.8 %	5.2 %	3.7 %	-56 Bil.

ADVISOR COMMENTS:

ECONOMIC: Tax cuts may overstimulate consumer and investment spending. Are you willing to accept more inflation?

POLITICAL: I talk to my chauffeur to get a sense of what poor people think, and she thinks your policies are just about perfect.

MILITARY: We need another twenty-floor parking garage at the Pentagon to accommodate all of our new personnel.

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